

period. This forecast was sent by telegraph to army and corps signal officers and to the Air Service. These units repeated the forecasts to the operating units directly concerned. The Air Service soon found it desirable to have a forecast made in the early afternoon covering the late afternoon and the first part of the night, particularly for use in connection with bombing and artillery observation.

Owing to the congested condition of telegraph wires as the First Army advanced in the Argonne area, the forecasters became convinced that an early issue of the forecast was desirable. Upon studying the situation it appeared that telegrams from the Signal Corps meteorological stations of the Services of Supply at 1 a. m., together with the 1 a. m. observation sent by telephone by the British, would permit of the construction of a satisfactory weather map, and the morning forecast was, therefore, issued between 5 and 6. The early arrival of the British data also permitted the afternoon forecast to be made before 6 p. m., and these changes were accordingly made. * * *

From information received from Artillery, Aviation, and General Staff officers, it appears that practically all bombing and a great deal of the artillery, gas, and other operations of the First and Second Armies were based upon the weather forecasts issued by the Meteorological Section of the Signal Corps. Gen. Mitchell stated that the forecasts were indispensable to the operations of the Air Service. The stations maintained by the Meteorological Section furnished timely notice of all squalls, and squall

warnings reached all Air Service units before any squall reached the lines. Timely notice of all dangerously high winds at the 300 and 800 meter levels was also given.
* * *

When the American Expeditionary Forces entered the field the Service Meteorologique aux Armees had developed a method of determining wind direction and speed above a cloud sheet; the method of "Sondage par le son." A study of this method showed that it was entirely feasible, and the results obtained by the French stations were used in determining artillery winds, and in weather forecasts on cloudy days. When the armistice was signed arrangements had been practically completed for taking over and operating as a part of the Meteorological Section, Signal Corps, American Expeditionary Forces, the *Sondage par le son* station at Chaumont sur Aire (Meuse).

Two factors essential to the success of the Signal Corps Meteorological Service should be mentioned. The first of these is the faithful and capable personnel which was furnished for the work. It was largely through the efforts of the Science and Research Division of the Signal Corps in Washington that the supply of these men was continued up to the end. The second factor is excellent communication service furnished. In spite of the fact that the meteorological messages are difficult of transmission and require night as well as day service, communication once established was thoroughly reliable. Failure in either of these essential elements would have rendered the work of the section less efficient in both the local and the forecast services.

NOTES ON THE METEOROLOGICAL SERVICE IN THE GERMAN ARMY FROM TRANSLATIONS OF GERMAN DOCUMENTS.¹

(From Bulletin de la Meteorologie aux Armees, January, 1918, pp. 65-79.)

Translated by C. LeROY MEISINGER.

I.

THE RÔLE OF THE METEOROLOGICAL SERVICE.

The documents analyzed show that the meteorological service in the German Army experienced a great development and that the command attached a high importance to all the reports furnished by the stations and the secondary posts. These reports were then adapted to the needs of modern warfare.

Forecasting.—The meteorological bulletins and the forecasts for the succeeding 12 hours were communicated twice daily, in the morning and in the evening. The bulletin contained:

1. A general forecast.
2. A forecast for wind. (Probable direction of the wind for the next period of 12 hours.)
3. A discussion of the possibilities for the use of gas shells. (C.)²

Collaboration with artillery.—For the useful employment of artillery tables, collaboration with the meteorological service was necessary.

The new organization of the meteorological service of the army and of the artillery satisfied this necessity. The meteorological information ought to be communicated at least three times daily, or more frequently if the need for it arises, especially at night, and in case of a sudden change. The reports contain:

1. Direction and speed of the wind in meters per second (if possible to an altitude of 2,000 meters).
2. Barometric pressure at the altitude of the battery.
3. Temperature. (E.)

Conforming to these instructions, the artillery command says, in its note of September 5, 1917: "The meteorological bulletin is issued three times daily. Each bulletin remains in force until the arrival of the next (except for precise firing, when the mean trajectory of the projectile is greater than 500 meters, and also for firing at night; in this case, it is necessary to have readings of barometric pressure and temperature immediately before firing). If, in the meantime, changes in the direction of the wind are noted, corrections are made by approximation." (F.)

For the execution of these requirements, a special service was created in the division. "A section, charged with the recording of atmospheric conditions (*Tageseinflustrupp*), is created for the division. Between 6 a. m. and 6 p. m., every four hours, the *Tageseinflustrupp* takes the barometric pressure and the temperature of the air, and from these given values the density of the air. The surface wind speed is noted at the same hours. Soundings are made in the morning, at noon, and at 6 p. m. The results are telephoned to the various units.

¹ (A) *Le service de surveillance contre les gaz dans l'armée.*—No. 7337, E. M. de la III^e armée, du 28 octobre 1916.

(B) *Tir de projectiles de Minervefer a gaz.* (Indications meteorologiques.)—Groupe d'armes du Prince heritier de Baviere.—E. M. Genie.—No. 8315, du 31 janvier 1917.

(C) *Organisation du service meteorologique du front.*—No. 432/17 du Q. G. de la 52^e D. I., du 9 aout 1917.

(D) *Instruction provisoire pour le service meteorologique du front de la VII^e armée,* du 13 juillet 1917.

(E) *Perfectionnement de la precision des tirs d'artillerie.*—G. Q. G. allemand.—Mo. 60.336 op., Ludendorf, 20 juillet 1917.

(F) *Étude sur l'utilisation rationnelle des tableaux journaliers de corrections atmospheriques.*—Commandement de l'artillerie.—No. 6783/17/1, du 5 septembre 1917.

(G) *La guerre mondiale.* (No. du 1^{er} decembre 1917.)—*Le service meteorologique dans l'armée allemande.*

(H) *Collection de bulletins meteorologiques.*

² Capital letters refer to documents listed in footnote 1 from which this information has been obtained.

In case of special operations, or upon request of the batteries, special observations are made also at night." (F.)

Service for surveillance against gas.—In the Third Army the reports on the current wind at the front are transmitted to the field meteorological station by:

1. The posts of aerial surveillance (*Fliegerwarten*) distributed behind the lines and supplied with wind vanes.

2. Posts for observing the wind (*Windwarten*),—a part of the army corps—situated a few kilometers in the rear of the lines, in places chosen by the chief of the meteorological station. They are occupied by two men. The chief of the meteorological station instructs the men on their work, and they are furnished the necessary instruments and other materials necessary to fulfill their mission.

These posts ordinarily take their observation at the regular hours, 6 a. m., 12 noon, and 8 p. m. and telephone the report to the chief of the meteorological station.

In the meantime, they watch the direction of the wind, with attention to possible changes. Especially do they watch for wind conditions favorable to the enemy, in which case the information is communicated without delay to the meteorological station. When the meteorological station, basing its conclusions on proper observations and upon the reports rendered by the observation post, deems that a gas attack is possible by the enemy, it warns the interested divisions.

If there is a change in the atmosphere indicating a diminution of danger of attack or complete cancellation of it, the divisions are so informed by the meteorological station.

The meteorological station is held responsible at all times for reports on the wind and general atmospheric conditions. (A.)

Conditions favorable for the use of gas shells.—For the rational use of gas shells, particularly in harassing fire, the creation of a meteorological service seemed necessary, as much for the companies of *Minenwerfer* as for the *Minenwerfer* formation in the infantry. This service was usefully attached for the meteorological observations for protection against gas.

In this manner, at the Sixth Army, the field meteorological station was formed for the companies of *Minenwerfer* at the front and for units of *Minenwerfer* in the infantry. This arrangement has given very satisfactory results. (B.)

II.

ORGANIZATION OF THE METEOROLOGICAL SERVICE.

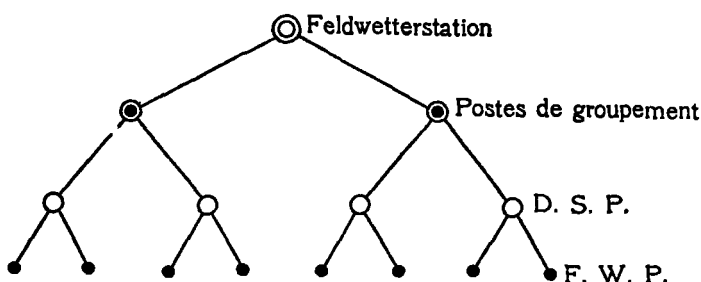
There exists in each army a field meteorological station (*Feldwetterstation*) which gives technical directions to the secondary posts at the front, and which provides instruction to the personnel of these posts. It seems, on account of the progress already realized, the new needs, and the organization already effected, the service ought to be the object of uniform organization, for in his note of July 20, 1917, Ludendorff declared himself for a new organization of the meteorological service of the army. (E.)

Also, on July 13, 1917, the commander of the Seventh Army wrote: "The beginning of general meteorological instruction at the front, of value to every army in the field, can not again be accompanied by a set of recent restrictions, for the army can not foresee the recurrence of the last application." (D.)

Perhaps one can place the date of the new organization between the 13th and the 20th of July, 1917. In every case it came in response to a pressing need, since the Seventh Army, since the 13th of July, 1917, estimates that the necessary meteorological advice for the operations with the use of gas, as well as for the safety of the troops, necessitated a fixed organization for meteorological service at the front, and, in the absence of a general instruction, prescribes that the following instructions be applied to the whole front of the Seventh Army:

The meteorological service at the front is organized by divisions under the orders of the staff officer in charge of gas or the division gas officer for all which concerns the protection of our troops.

Each division establishes a central division post (*Divisions-Sammel-posten*: D. S. P.) composed of two noncommissioned officers; it will establish beyond some line posts of observation (*Feld-Wetter-posten*: F. W. P.). The D. S. P. and F. W. P. follow the division in its movements.



Schematic diagram of meteorological organization of the Seventh German Army.

Every two hours (at 0 hr., 2, 4, etc.) the F. W. P. reports the direction and speed of the wind and transmits these observations at 6 a. m. and at 4 p. m. by telephone to D. S. P. In special cases, more frequent reports will be issued to the D. S. P. upon the request of the staff officer in charge of gas or the division gas officer.

The F. W. P. will concentrate their attention on all manifestations which might enable the enemy to make a gas attack. They will immediately inform the commander of the sector and will forward a message to the D. S. P. which will be sent to the division gas officer.

The D. S. P. combines the observations of the F. W. P., verifies them, and forwards them weekly to Meteorological Station No. 1 (*Feldwetterstation* of the Seventh Army). With the aid of the reports rendered by the F. W. P. the D. S. P. can constantly keep their division gas officer informed as to the state of the wind for their sector. The D. S. P. will receive regularly the forecasts of the meteorological stations of the front and will take care to forward quickly these reports to respective authorities of their D. I. [?] They are not authorized to give by themselves an opinion concerning the weather. For that, they are required to ask the meteorological station No. 10 which will give them the desired report.

The instruction of the D. S. P. will be given by the meteorological station. They will instruct in turn the F. W. P. The personnel will be chosen from men showing the required aptitude: scientific and technical men.

To complete the forecasting and giving of information on occasion of operations where gas is used, also

to complete the work of the meteorological station on the army front, each group will be posts for meteorological grouping. These posts will be organs of their sector under the technical direction of the staff officer in charge of gas. They will follow the instructions of the meteorological station on all technical questions concerning meteorology. They will issue regularly to the D. S. P. all forecasts of the *Feldwetterstation*, and will serve as intermediaries in transmitting information regarding storms and squalls. (D.)

III.

TECHNICAL REPORTS.

Reproduction of a meteorological bulletin:

BULLETIN OF THE METEOROLOGICAL OBSERVATORY OF CREPY.

Date: 8/9/17.
Pressure (sea level): 759 mm.
Humidity: 94%

Time: 7 a. m.
Temperature: 13° C.
Visibility: Ordinary.

FORECAST	Altitude (meters).	Wind direction.	Wind speed (m/s).	Altitude (meters).	Wind direction.	Wind speed (m/s).
8 a. m. to 8 p. m.						
1st. Partly cloudy; sky occasionally clear; generally dry.	100 200 400 600 800	Calm. e. ne. s. Calm.	 4 2 2	1,000 1,500 2,000 3,000	Calm. sse. sse. se.	 8 11 12
2nd. Gentle SE. winds.						
3rd. Atmospheric conditions not favorable for us to use gas shells.						

b. *Transmission by telephone of observations of posts at the front.*—The posts at the front give the direction of the wind in 16 compass points and its speed in meters per second. The tabulation and the telephoned messages are constructed with the aid of the formula WWS, by replacing WW with two figures indicating the wind direction, and S with the number of meters per second which have been observed.

In case of a threatening squall, the word *squall* is added next to the mean speed of the wind, and, if possible, the estimated change of wind direction. If the speed of the wind exceeds the indicating possibilities of the anemometer, the S is replaced by X.

Hour.	Abbreviations.
4 a. m.	4 v.
12 noon.	12 m.
6 p. m.	6 n.
12 midn.	12 n.

Example:

Observation as made.	Message as sent.
North wind, 3 meters per second.	323
SSE. wind, 8 meters per second.	14 X
NW. wind, 3 meters per second.	283
Calm.	000 (D.)

c. *Material.*—The stations are provided with all the instruments and accessories used in meteorology. As examples one can note that they possessed an automatic rain gage, a cinemograph, and a sunshine recorder. The pilot balloons are of red paper and are provided with a rubber appendix. The observation stations are mounted on towers and have glass windows, oriented in all directions, permitting in case of bad weather, the continuation of observations. (G.)

d. *Meteorological indications for the use of gas shells.*—The chief of the field meteorological station of the Sixth Army gives a very precise and detailed report on the meteorological conditions, topographical influence, the observation of wind in the trenches, and on the forecasting of wind for the use of gas shells.

ARMY GROUP
of the
CROWN PRINCE OF BAVARIA.
GENERAL STAFF.
Annex to No. 8315

Field Meteorological Station 6 A. O. K. G.

METEOROLOGICAL CONDITIONS FOR USE OF SHELLS "D."

I. CONDITIONS OF WEATHER.

While, originating from cylinders, the quantities of gas are nearly unlimited for a short time and are carried by the wind against the enemy, gas shells and gas mines carry against the enemy limited quantities of liquefied gas which evaporates slowly. Therefore, the maximum effect of gas shells will be felt in a complete calm, more in a vertical sense than in a horizontal, or when there is only a gentle wind blowing toward the enemy. The upper limit of the speed of the wind in this case is in the neighborhood of 1.5 meters per second.

The calmness of the air increases generally during the night; therefore the early hours of the morning are most favorable for the use of gas shells. The early hours of the night present, among others, a difficulty which invites, in every case the greatest care; especially after sunset, the temperatures at the surface, due to unequal absorption and radiation over varying terrain, tend to equalize themselves. The lower layers of the atmosphere are at that moment agitated by continual and irregular convection, which renders quite possible a turbulent state of air.

In rainy weather, one can not fire, because the rain beats down the gas against the ground. In foggy weather gas shells can be used in certain cases but the density of the air must be taken into account.

The notes on the influence of temperature are to be found in "Instructions on munitions 'D.'"

It is interesting to know in what measure the conditions of wind are favorable for the use of gas.

Contrary to the conditions for firing gas shells, the gas, in the case of firing mines, is more dangerous for our own trenches; for the use of gas mines, the nights are chosen when the air is not completely calm, in order to avoid a very gentle wind blowing the gas back. It is necessary to have a gentle wind blowing against the enemy; also the possibilities of firing are more limited than with gas shells.

On the whole, in central Europe, westerly winds are the most frequent. If we arrange the winds in order of frequency, beginning with the most rare, we obtain the following series: SE., S., E., NE., N., NW., W., SW. The coefficients of relative frequency change a little at each place due to its relation to the ocean; but the series remains nearly the same.

It follows that, in a trench which faces the NW., the gas mines can be fired more rarely than in a trench facing the NE. The other directions naturally vary between.

For firing the gas, it is not always necessary that the wind always blow absolutely against the enemy perpendicular to our trenches; a variation as great as 60° from the normal is permissible.

Theoretically one can admit a scope of 180°, inasmuch as, in this limiting case, the gas carried into the trenches of the enemy will follow the length of the enemy trenches; but, since the wind varies somewhat every day, it is recommended to preserve an angle of safety of 30°.

II. INFLUENCE OF THE TERRAIN.

One can admit in principle that all the terrain which accentuates the calm increases the effect of the gas. Therefore, high stiff grass, brush, etc., retards the movement of the air, although it is possible to fire on this terrain with gas shells as well as when the wind is about 2 meters per second on uncovered land.

The gas being heavier than the air, a terrain which slopes toward the enemy is better to fire upon than a flat surface, a flat surface is better than a rising one, where one is not assured against a reflux except with a wind of more than 1 meter per second.

III. THE OBSERVATION OF THE WIND.

a. *In the trenches.*—To determine the direction of the wind, the ordinary wind vane may be used, but if this is not available it is sufficient to attach a strip of cloth to the top of a stick. The direction which smoke passes above the trenches is also a good indicator. One obtains the best results in lifting the vane above the trench, for in the trench and in the immediate vicinity the local air currents can have a direction different from that of the general movement of the air. The trenches afford a system of depressions which have their own peculiar circulation of air; thus, it is between 0.5 meter and 1 meter above the parapet that the normal wind is found.

Analogous remarks may apply to the determination of the speed of the wind; the best results are obtained with the aid of a Fuess anemometer, universally in use in the field meteorological stations.

It seems that the companies of *Minenwerfer* measure the speed of the wind regularly each evening and each morning, whether or not they intend to use gas. In part the companies are able to know the wind in their sector. At any rate, if the enemy knows that the measure of the speed of the wind is a regular practice, his attention will not be aroused, except that that practice can also be well used by us for protection against gas.

Two other services are interested in the observation of the speed of the wind: First, the company of *Minenwerfer* engaged in the protection against gas, which also has need of good observers at the front. In place of using untrained foot soldiers, the divisions will have the advantage of turning to account the organization of the pioneers.

It follows that during a gas attack the observation of wind speed should be continually made. The observation of the wind direction should be continuous; for the speed of the wind, ordinarily it is sufficient every half hour.

b. *Behind the lines.*—It is recommended to start a smoky fire at a place well chosen in the rear, for example, at the headquarters of the army corps. A line can be traced parallel to the first-line trenches, and the smoke observed with respect to this line. It is possible to deduce from this observation not only the direction and speed of the wind but also its nature. If the smoke trails tranquilly at the surface of the earth, it is advantageous to fire; if, on the contrary, the wind stirs up the smoke, a gas attack will not give the required result.

It is advised to check the direction of the wind obtained from that observation. The best means of doing this is to observe the direction from which sounds seem nearer. This will show the continuous nature of the wind. If the direction indicated by the direction of sound is identical with that observed, one can conclude that the current is homogeneous.

IV. FORECASTING THE WIND.

The forecasting of wind, in the case where a meteorologist can not be found among the pioneers, is demanded of the field meteorological station of the A. O. K. In this connection the following method is recommended:

The meteorological station gives each day, between 6 and 8 p. m., a forecast of the weather good for the following night to E. M. of C. A., and to independent divisions. The E. M. transmits to the front these communications in the interest of protection against gas.

Later, one adds to the text a supplementary mention of the possibility of firing gas mines, indicated "D." The front of the Sixth Army can be divided into elements of like orientation: a, b, c, etc., in which each one is designated a wind with relation to its orientation for use of gas shells. If the meteorological station anticipates an east wind, the supplement will therefore conclude:

"Direction of the wind good for Da, good with reservations for Dd and De."

The wind is said to be "good with reservations" for the sectors d and e because one could not use gas mines in this sector with oscillations of wind exceeding 15°.

This text, conforming to decision II, No. 34.283, op. of September 13, 1916, of the chief of the general staff of the field armies, is intended for combat units. It should be communicated, with necessary orders, to companies of *Minenwerfer*.

When a direct explanation is necessary between the trenches and the field meteorological station it is better not to use the conventional terms to designate the direction of the wind, etc., but to speak of wind in clear language, concerning questions of protection against gas.

Example: A position, situated facing the west, receives from the station the following report:

You do not need to fear a gas attack to-day, for we can count on a gentle east wind; on the contrary, it will be possible that during the morning the enemy may make a gas attack, for a complete calm is forecast for that time. This applies especially to the places where the slope rises toward the enemy.

It is preferable, when a gas attack is contemplated, that a meteorological consultation will be made by the intermediary of the commander of the pioneer units.

(Signed) v SCHMAUSS.

7th Army, General Staff.
No. 14.883.

General Headquarters 6/2/17.

To be communicated to all the groups, all troops in the rear, and the training schools.

For the Commanding Officer:

v BORRIES,
Major General, Chief of Staff.

SQUALL WARNINGS.

[Abstract of "L'Avertissement des Grains," Bulletin de la Météorologie aux Armées, Oct. 15, 1916, pp. 1-12.]

Squalls, which have proved so dangerous to aviation and destructive in general, through the suddenness of their appearance and the violence of their passage, are characterized by a considerable sudden variation in wind direction, sometimes the appearance of hail, or thunder and lightning, sudden increase of barometric pressure and humidity, and a rapid drop in temperature. There are abundant instances in which aviators, surprised by

the suddenness of the squall, have been lost. Three zones in the life of a squall can be discerned; first, that in which the squall begins, and where it is impossible to give warning; second, that in which the squall reaches its maximum effectiveness, for which warnings are indispensable; and third, that in which the squall is decreasing, in which warnings are unnecessary. The military squall-warning service of the French Army was established to combat the second stage, in which the phenomenon is most dangerous. To determine the existence of squalls and their characteristics, to estimate their force and the danger they present, and to disseminate the information to those interested, were the functions of three distinct divisions in the warning service: The first by the observation posts (*postes d'observation*), the second by the central office where the reports were received, and the third by the *service de diffusion*. The warning service was very efficient and was usually able to warn air-service units three-fourths of an hour before the arrival of the squall; it is estimated that such warnings were given in 85 per cent of the squalls.—C. L. M.

NOTES, ABSTRACTS, AND REVIEWS.

PROGRESS OF METEOROLOGY.

By W. H. DINES.

[Extracts from *Nature*, Nov. 6, 1919, pp. 247-248.]

"The progress of meteorology during the last 50 years has been very marked, as may be seen by a casual reference to the current meteorological literature of the period 1865-1875; to a great extent, it resembles the emergence of astronomy as an exact science from the old astrology, but it must be confessed that the Newton of meteorology has not yet appeared.

"Fifty years back the student of meteorology spent much of his time in a vain hunt for weather sequences, and the principle of *post hoc propter hoc* held full sway; the laws of motion and the more recently discovered laws of thermodynamics were in most cases completely ignored, or at least considered as not being applicable to meteorology. This has been largely changed for the better, and one does not now expect to find a cold area explained as being due to the descent of air in an anticyclone from a higher and colder region. Perhaps the pendulum has swung too far the other way, and mathematical analysis may sometimes be used when it is not applicable. On the assumption that air is a perfect fluid, it follows from a strictly mathematical analysis that a sphere exposed to a steady current of wind will offer no resistance to that wind, a result obviously inconsistent with the facts. The assumption made can not be justified, and one can not help feeling that great caution should be used in making assumptions if the result of a complex mathematical investigation into a meteorological question is to be trustworthy. Mathematics, however, afford a most useful and often indispensable aid to meteorology, and of late years especially, although far from exclusively, by their means many useful deductions have been drawn."

The remainder of the paper discusses recent advances in the study of cyclones and anticyclones, being essentially a summary of the material presented by the au-

FORECASTING LINE SQUALLS IN WEST AFRICA.

By H. HUBERT.

[Abstract reprinted from *Science Abstracts*, July, 1919, pp. 312-313. Original article in *Comptes Rendus*, 168, Mar. 17, 1919, pp. 567-570.]

From observations made in Senegal in winter it can be shown that line squalls, similar to those experienced in northwest Europe, occur in that region also. The mean direction of propagation is, however, from east to west, instead of from west to east, which is the mean direction of propagation of the line squalls of our latitudes. The mean velocity of propagation is 60 kilometers per hour, the extremes being 44 and 72 kilometers per hour. The direction of the line along which the disturbance is found at any time is generally north-south. The length of the line may exceed 100 kilometers, and the passage of a squall has been traced for hundreds of kilometers. Nothing is said as to changes of wind and weather accompanying these line squalls. Further observations are needed in districts adjacent to Senegal in order to investigate these squalls more precisely, but already sufficient stations exist in Senegal to permit of a warning of the approach of the squall to be issued a few hours (up to six or eight) in advance of the event.—R. C.

thor in Geophysical Memoir No. 13,¹ an abstract of which, by Mr. W. R. Gregg, has been published in the *MONTHLY WEATHER REVIEW*.² After this discussion he concludes with the observation that "meteorologists have good cause for congratulation in the steady progress that is taking place."

THE AMERICAN METEOROLOGICAL SOCIETY.

"The organization of the American Meteorological Society on December 29, 1919, in St. Louis, Mo. * * * marks the beginning of a movement not only to push forward investigations of weather processes and climatic conditions, but also to widen the valuable applications of the knowledge already at hand. The great use of meteorology in warfare has shown that there are large possibilities of extending it much more thoroughly into almost every line of human endeavor."³ Significant of a recognition of this is the fact that nearly half of the present membership of nearly 600 is composed of people who find use for meteorology in their work, yet who are not professional meteorologists, or interested merely as amateurs.

The objects of the society as stated in the constitution are: "The advancement and diffusion of knowledge of meteorology, including climatology; and the development of its application to public health, agriculture, engineering, transportation by land and inland waterways, navigation of the air and oceans, and other forms of industry and commerce." To carry out these objects 11 committees have been formed: 4 to have in hand the advancement and diffusion of knowledge of meteorology, and 7 to have charge of the development of the numerous applications of meteorology to human affairs.

A total of 29 papers were presented at three sessions of the society in St. Louis, December 30 and 31, 1919, and in two sessions at a coordinate meeting in New York City January 3. Joint sessions were held with the American Physical Society and with the Association of American Geographers and National Council of Geography Teachers. In this issue of the *REVIEW* there are published five of these papers in full, extensive excerpts from

¹ Dines, W. H.: Characteristics of the Free Atmosphere, Geophysical Memoirs, No. 13, Meteorological Office, London, 1919, M. O. 239c, pp. 47-76.
² Monthly Weather Review, September, 1919, pp. 644-647.

³ Excerpt from the Bulletin of the Am. Meteorological Society, Jan., 1920, vol. 1.